Editorials

Musings on Whither Medical Education

THERE IS A GROWING FEELING that something is wrong with medical education. Perhaps it has ever been thus, but now the complaints seem more strident and more frequent. Some think the time of education too long, others, too short. There are those who think it teaches too much basic science, replaces ideals with cynicism, or destroys good attitudes. Quite a few think it produces too many physicians who are more interested in impersonal science than in the more personal aspects of caring for patients. Yet withal, the system has produced good doctors, certainly the world's best trained doctors, but an uncomfortable feeling persists that they may not be all that well trained for what they are really expected to do. There is an unsettling sense that too many of them have much, perhaps too much, to learn about the real world of patient care after they have finished their formal training and find themselves out in practice.

Medical educators seem somehow loath to change anything very much. For many, their principal interest and hands-on experience is with modern medical science, and the educational system they dominate seems to have been designed to teach as much of this science as possible. Yet maybe it is time to ask to what extent the practice of medicine or health care is really hard science, or science at all, or put another way, just how much bioscience does one need to know to practice good medicine? Are there other experiences and skills that are important, perhaps even just as important?

There is good reason to believe that a new and different emphasis in health care is beginning to add some quite new dimensions to the traditional diagnosis and treatment of the sick. For example, more attention is being given to health and being well and to the prevention of illnesses and injuries that result from such things as aberrant human behavior, unhealthy lifestyles, economic or cultural deprivation, or an unhealthy working or living environment. This is relatively new in patient care and is clearly adding new dimensions to medical practice and health care. Are these new dimensions not, or should they not, also be essentials for an adequate medical education? And could it be that this lack in most physicians' interest and training is one reason why vacuums are beginning to appear in what one might expect to be the scope of medical practice, vacuums that are beginning to be filled by other health professionals who may not have the expertise that is really needed: the scientific and experiential expertise of physicians?

If there is any truth to all of this, it is hard for a thoughtful person not to believe that something is wrong with medical education. If so, there is much at stake for the future of the medical profession. Some might even suggest that medical education seems to be traveling down a dead-end street, heading for some kind of a cul-de-sac of bioscience, while forgetting that the main road of medical education should lead in the direction of producing physicians trained to meet the evolving needs of today's patients and today's society.

Change, if there is to be any, must come either from within or without. There will need to be pressures from somewhere. Will those pressures come from the medical profession, the medical educators, or the government? Actually, each has recognized a need and has tried to bring about some change. The American Medical Association and the Association of American Medical Colleges have both conducted formal studies and made formal recommendations, but so far, little significant change has resulted. A few of the specialty boards have begun to add new requirements that will bring more human dimensions to graduate medical education in those specialties. One or two medical schools are instituting substantive curricular changes that attempt new and more realistic approaches to teaching and learning that may begin to address new professional and societal needs. One can hope that some will prove to be useful as models. But perhaps the most effective change agents to date have been the government initiatives that promote the education and training of much-needed primary care specialists, that train physicians and other health professionals to practice in the still medically underserved areas and with underserved groups, especially minorities. Other actions by government have begun to reduce the funding available for the graduate training of specialists and subspecialists who are no longer needed in the same numbers and may even be adding disproportionately to the cost of health care.

Again, there is much at stake in all this for the future of the medical profession and health care in this nation. Events in the real world are moving rapidly. Much more needs to be done to educate and train young physicians in the right numbers and with the right preparation to understand and to effectively do what is rightly expected of them in medical practice and health care, not just in the coming decade but well into the next century. The lead time for doing what needs to be done in medical education is uncomfortably short.

MSMW

Cystic Fibrosis—On the Threshold of a Rational Therapy

THREE EVENTS DURING the past 50 years mark the major advances in our understanding of cystic fibrosis, a relatively common genetic disorder with protean manifestations and, even today, a rather grim prognosis. The first of these involved a detailed pathologic[1,2] and clinical[2,3] description of cystic fibrosis that permitted separation of this group of patients from others with similar signs and symptoms. These reports and the extensive descriptive clinical literature that appeared in the next two to three decades were substantially augmented by the second of these major events—that is, recognition of an abnormality in sweat electrolyte content[4] and the design of a convenient, safe, inexpensive, and reliable method for the measurement of sweat electrolytes.[5] Improved case detection, early therapy, reliable epidemiologic studies, and a focus of a considerable amount of research on water and electrolyte transport mechanisms in normal persons and patients with cystic fibrosis resulted from the development and wide use of sweat tests in clinical practice. The third event began two years ago and continues. That is, the "CF gene" has been localized to a region on the long arm of chromosome 7,[6-10] and the suggestion was made in a recent publication that the gene itself may have been located precisely.[11]

The first case described in the Specialty Conference elsewhere in this issue of the journal and the discussion by Drs Harwood, Edwards, and Nyhan illustrate the impact of these

landmark events. The child had intrauterine and early postnatal signs of the multisystem manifestations of cystic fibrosis. Meconium ileus, meconium peritonitis, diarrhea, and a failure to gain weight are manifestations of pancreatic insufficiency. His recurrent respiratory problems, requiring two additional admissions to hospital, were typical of the effects of the chronic intermittent inflammatory disease of airways in patients with cystic fibrosis. The disease was definitely diagnosed at age 2 months by the finding of an elevated chloride concentration in sweat in the context of these symptoms. Although nutritional problems were prominent in this patient's course, it is clear that the most important cause of morbidity and mortality—accounting for more than 95% of all deaths due to cystic fibrosis—is related to the respiratory system. Chronic bronchitis and bronchiolitis with intermittent involvement of lung parenchyma, colonization with a mucoid form of *Pseudomonas aeruginosa,* and the functional consequences of progressive destruction of the pulmonary architecture ultimately lead to cardiopulmonary failure.

In spite of advances in therapy and the promise of some recent approaches to the management of the pulmonary disease, such as aerosolized antibiotics, systemic anti-inflammatory agents, vaccines, and the like, the prospect for definitive treatment of this aspect of cystic fibrosis remains uncertain. Nevertheless, substantial developments in the use of noninvasive diagnostic methods, alluded to by Dr Edwards, and improved treatment of the complications of chronic obstructive pulmonary disease will be of benefit. Perhaps the Western Consortium CF Database referred to by Dr Harwood will assist in the evaluation of new and "established" approaches to therapy while fundamental studies directed toward basic mechanisms are in progress. The collection and storage of and access to medical data require attention not only in the case of patients with cystic fibrosis but for patients with any complex condition requiring input from many specialists in diverse disciplines. We should not underestimate, however, the formidable problems involved in generating even a limited patient data bank. The National Cystic Fibrosis Foundation, after more than five years of effort in that direction, has only recently put a modest system in place.

The truly remarkable progress of the past two years, summarized in Dr Nyhan's remarks, deserves some consideration inasmuch as opinions will be solicited among physicians outside the fields of genetics, pulmonary medicine, and other specialties relevant to the care of patients with cystic fibrosis and clinical research in this patient population. Moreover, the questions are similar to those raised in the context of other genetic disorders and even acquired diseases, such as the acquired immunodeficiency syndrome. It is certain that pressure will be generated for screening programs to detect heterozygous carriers of the mutant gene in large populations, for the antenatal diagnosis of cystic fibrosis, and application of the findings for abortion of an affected fetus. Clearly such programs and decisions raise many complex issues, only a fraction of which have been addressed by the medical and scientific community.

Technical concerns about the application of linked genetic markers and the provision of adequate counseling services by persons competent to evaluate the genetic data are but two of these questions already explored by investigators and clinicians. Considerable time and effort have been given to ensuring quality control, but other questions have been less widely discussed. For example, should large populations be screened for the cystic fibrosis gene defect? What will the consequences be for those persons identified as carriers of the gene? What of their offspring? Will medical and life insurance be available to them? What job opportunities will be denied to them? Who will pay the costs of screening? Finally, will elective abortion of an affected fetus be justified if the median survival of patients with cystic fibrosis increases to 40 or 50 years rather than 21 years, as it is today? Many of these questions involve personal choices, but others are matters of public policy about which physicians will be consulted.

In any event, the most important effect of the application of this work to the problem of cystic fibrosis will be a definition of the molecular basis of the disease. Recent studies have identified a defect in epithelial ion transport that is demonstrable in vivo and in tissue culture. Several investigations suggest abnormal chloride transport in sweat ducts and airway epithelium that, based on the data from Frizzell and co-workers[12] and Welsh and Liedtke,[13] could result from either a defect in the ion channel, a defect in a regulator of the channel, or a specific inhibitor of the channel in the cystic fibrosis cells. Both laboratories have studied chloride channels using patch clamp techniques. This method allowed analysis of single channels in situ and in excised patches. These β-adrenergic gated chloride channels are defective in the cystic fibrosis cell but active in the excised patches, suggesting a defect in channel regulation as the most likely of the possible mechanisms.

In the late 1940s the median survival for patients with cystic fibrosis was less than 1 year of age. By the mid-1970s the prognosis for patients with cystic fibrosis improved to about what it is today: a median survival of almost 20 years. That is, over the past decade, little progress has been made in the treatment of this disorder. Recent work in R. Williamson's laboratory[11] suggests that a candidate for the "CF gene" has been isolated. Further work to test this hypothesis is in progress and definitive data on this point will soon be in hand. Identification of the gene product and the defect responsible for cystic fibrosis will likely either affect therapy directly or focus efforts toward a more rational approach to the management of patients with cystic fibrosis. One can safely predict that this will have a major impact on the morbidity and mortality due to this disease.

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AIDS, Cancer, and Snakebite— What Do These Three Have in Common?

AN ESTIMATED 1 million persons throughout the world are bitten each year by venomous snakes; the number of deaths must approach 100,000. In the United States, approximately 45,000 people are bitten by various venomous and nonvenomous snakes annually, while about 8,000 of these are bitten by poisonous snakes native to our country. Venomous snakes are found in every contiguous state except Maine, while bites by these reptiles are most common in Texas, Florida, the Carolinas, Georgia, Mississippi, Louisiana, Arkansas, Oklahoma, Arizona, and California. Obviously, the incidence of snake venom poisoning is highest where humans and snakes overlap or cohabitate, although the actual number of snakes may be far higher in some more remote areas of our country.

About 70% of all bites by venomous snakes in the United States are inflicted by rattlesnakes (genera *Crotalus* and *Sistrurus*), 20% by copperheads *(Agkistrodon contortrix)*, 9% by water moccasins or cottonmouths *(Agkistrodon piscivorus)*, and less than 1% by coral snakes *(Micrurus* and *Micruroides)*. The incidence of bites by exotic (non-US) snakes is on the increase and is highest in New York, Boston, Miami, Los Angeles, and San Diego. Approximately 30 such cases are known for 1984.

As can be expected with such a highly variable type of poisoning, it is difficult to recommend a single therapeutic protocol for snakebite, not only because of the differences in the toxicity of the venoms of the different species, but because of the differences in the amount of venom a snake may inject. For example, in my experience with more than 900 cases of snake venom poisoning, and with respect to the rattlesnakes, 24% of the bites did not involve envenomation—that is, they were dry bites. In about 50% of the elapid (cobra, krait, and coral) bites seen by me, there was no poisoning, and statistics for sea snake and true viper bites also indicate, among other things, that there is a wide variation in snake venom poisoning. This obviously gives rise to all manner of folk and native cures, many of which, like the most recent suggestion of electroshock, find their way into the medical literature.

The basic therapeutic approach throughout the world during the past 50 years has been the use of antivenin. It has been said that antivenins have saved 75% of the lives that would have been lost had we not had recourse to this antitoxin, and there is no question that morbidity, worldwide, has been greatly reduced and hospital time and medical costs cut drastically through the use of this agent.

The use of antivenin has had its problems, however. Some of the early antivenins (1906-1930) more often than not precipitated serious reactions, which in those days sometimes ended in death. Today's antivenins can be considered both effective and safe, although they could be improved upon. Only one death in the United States during the past 35 years has been attributed to anaphylactic shock precipitated by the antivenin used for rattlesnake bites. This record can be equaled by few other drugs. The contention that antivenins are dangerous because of the high number of delayed serum reactions following the use of horse-host antivenins is not warranted and is indeed poor advice, in view of the simplicity of the reactions and the availability of effective follow-up care.

The major question when using any antivenin is "How much?" This is not easy to answer, as it depends primarily on the degree of envenomation, which in some cases may be difficult to determine. The various ad hoc committees on snakebite of the World Health Organization have wrestled with administration times and doses for more than 20 years. One conclusion has become obvious. In the 1950s and 1960s, all of us used far too little antivenin in terms of individual cases, and our results were, as might be expected, encouraging but not elating. The late H. Alistair Reid of the Liverpool School of Tropical Medicine told me that he used twice the number of vials of antivenin for a specific degree of severity of snakebite in 1983 as he did in 1963. My own practice over 30 years reflects a similar course.

If one considers that 25% of all crotalid bites do not end in envenomation, and another 15% are so trivial that they require no more than cleansing the wound, applying a dressing, and giving the appropriate antitetanus agent, this leaves only 60% of all such bites requiring antivenin. Because few copperhead bites need to be treated with antivenin, it would not be surprising that, if the appropriate data were available, perhaps no more than 50% of all crotalid bites in the United States require antivenin treatment. All cases, however, whether poisoning has taken place or not, should be observed for four hours, and a complete blood count, urine analysis, and clotting screen should be carried out.

Perhaps one of the commonest misunderstandings in treating snake venom poisoning in the United States relates to the advice accompanying Wyeth's antivenin [Crotalidae] polyvalent. The instructions in the brochure regarding *minimal, moderate,* and *severe* envenomations refer to those cases *requiring* antivenin, not to all rattlesnake, copperhead, or cottonmouth bites. In other words, these instructions pertain to those cases in which the attending physician decides that the use of antivenin is indicated.

A questionnaire distributed to 32 physicians throughout the United States who currently treat a sizable number of snakebites indicates that the average number of vials used in minimal envenomations is 7.2, in moderate envenomations 11.4, and in severe ones, 18.6. When antivenin administration was delayed more than four hours, the dose was almost doubled. It is well established that the effectiveness of antivenins is dose- and time-related. In the above survey, immediate reactions were seen in 7% of the patients, but in 3% they disappeared when the antivenin therapy was stopped, diphenhydramine hydrochloride given, and the antivenin administration restarted at a slower rate. Less than 1% of the patients experienced an immediate serious or anaphylactic-"like" reaction. In about 70% of the cases a delayed serum reaction developed, with most cases responding to diphenhydramine, although 7 of 400 patients had to be admitted to hospital and treated with steroids or corticosteroids.

The average hospital stay for antivenin-treated patients in the survey was 3.1 days, while the average duration for those not receiving antivenin was 6.3 days, and that for patients having a fasciotomy, with or without antivenin, was 9.6 days. Hospital costs were obviously much higher for patients having a fasciotomy. There were two deaths in patients who underwent surgical procedures without receiving antivenin.